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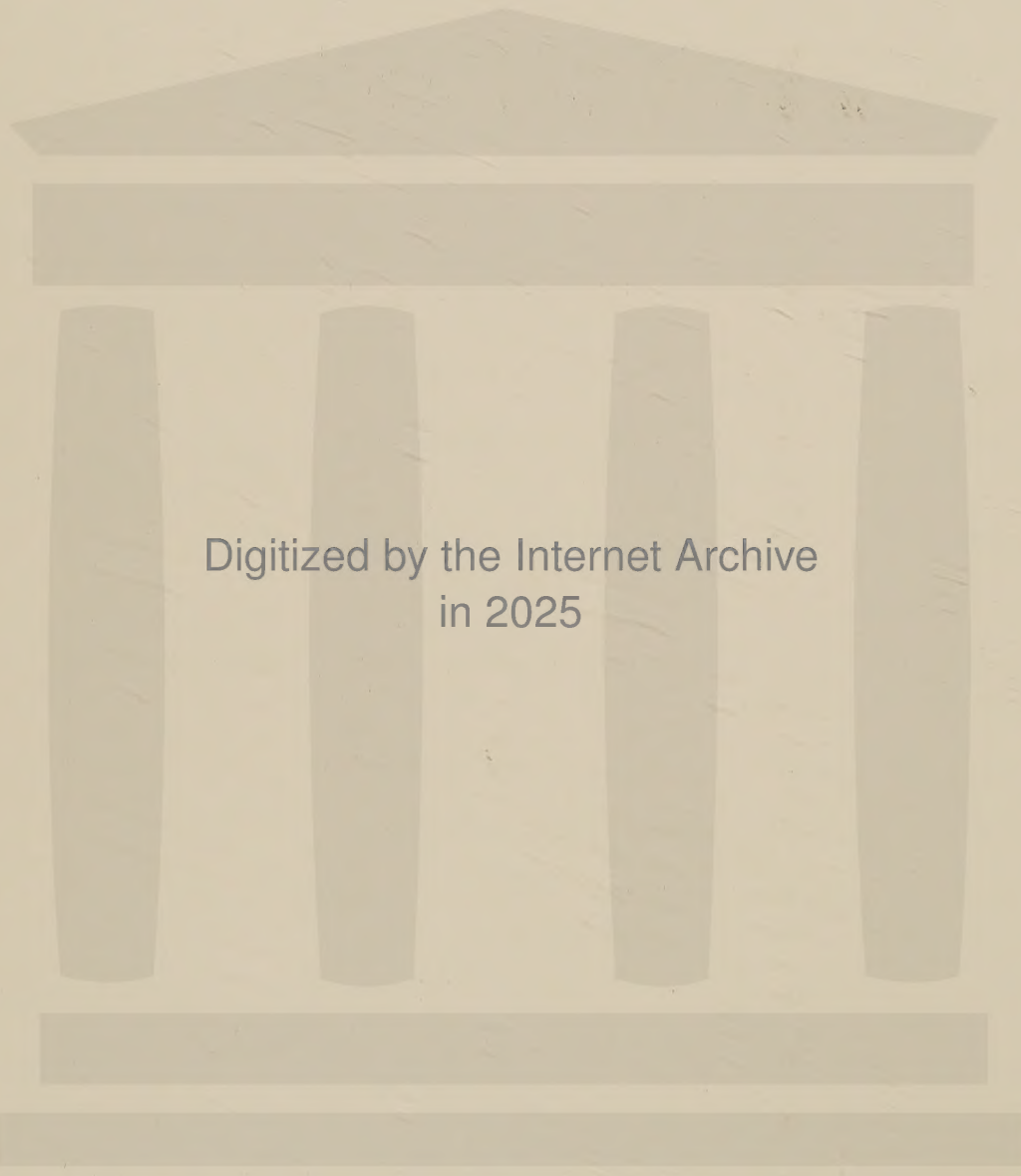
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SOUTHWEST FISHERIES CENTER

MONTHLY REPORT - MARCH 1978

RESEARCH HIGHLIGHTS

	Page
Mathematics of Markov Decision Processes Being Investigated	3
Townsend Cromwell Returns from Survey and Assessment Cruise to Northwestern Hawaiian Islands	5
Manuscript Describing Thermoregulation in Yellowfin Tuna Completed	7
Anchovy Plan Adopted by Council	8
Cooperative U.S.S.R.-U.S. Hake Survey Completed. Preliminary Results Indicate Hake Biomass Somewhat Larger than in 1977	10
Fish Eggs and Larvae Reared for Study of Life History Series	12
Delayed Feeding Experiments Repeated with Anchovy Larvae	13
Mexico and U.S. Continue Information Cooperative Research and Data Exchange	16
Research Chiefs Selected for Marine Mammal Programs	17
First Research Cruise Completed Aboard Dedicated Tuna Vessel	18
Sampling of Foreign Caught Atlantic Tunas is Reported for 1977	19
Significant Changes in Weather Patterns Reported in Fishing Information . .	21
Results of 1977 Cooperative Marine Game Fish Tagging Program Available . .	22
Recent Anomalies Noted in Winter Atmospheric Forcing of Near-Coastal Processes in the California Current	23
Industry Enthusiastic on Prospects for Development of Domestic Hake Fishery	25



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HONOLULU LABORATORY
LA JOLLA LABORATORY
TIBURON LABORATORY
PACIFIC ENVIRONMENTAL GROUP

MONTHLY REPORT - MARCH 1978

STATUS OF PUBLICATIONS

Published

Sakagawa, Gary T., Atilio L. Coan and Ted C. Murphy. 1977. A review of the yellowfin-skipjack tuna fishery of the Atlantic Ocean and American participation, 1956-75. Marine Fisheries Review 39(12): 1010.

Smith, Paul E. and Sally L. Richardson. 1977. Standard techniques for pelagic fish egg and larva surveys. FAO Fisheries Technical Paper No. 175, 100 p.

This publication is one of a series of FAO manuals in fisheries science. It has been prepared as part of the program of the Fishery Resources and Environment Division and is largely based on the work of a Working Party on Fish Egg and Larval Surveys established following the recommendation of the Fourth and Fifth Sessions of the FAO Advisory Committee on Marine Resources Research.

The manual will be primarily for use in FAO field projects and training courses, and by national institutions, especially in developing countries, which may be conducting fish egg and larval survey programs. The final edition of the paper in the official languages of FAO will eventually be published incorporating any revisions that may be proposed by the users of the manual.

Through a contract awarded to the NMFS Southwest Fisheries Center, the present version of the manual was prepared by Drs. Paul Smith of the La Jolla Laboratory and S. Richardson of Oregon State University.

This report does not constitute publication and is for information only.

Approved by Center Director

- W. F. Perrin, W. E. Evans and D. B. Holts. Movements of pelagic dolphins (Stenella spp.) in the eastern tropical Pacific as indicated by results of tagging, with summary of tagging operations, 1969-1976. For publication in NMFS Special Scientific Report--Fisheries.
- J. R. Hunter, J. H. Taylor and H. Geoffrey Moser. Effect of ultraviolet irradiation on eggs and larvae of the northern anchovy, Engraulis mordax, and the Pacific mackerel, Scomber japonicus, during the embryonic stage. For publication in Photochemistry and Photobiology.
- William F. Perrin and Joseph E. Powers. The role of a nematode (Crassicauda sp.) in the natural mortality of a dolphin (Stenella attenuata). For publication in the Journal of Wildlife Management.
- William W. Fox, Jr. The tuna-dolphin problem: Five years of remarkable progress and future outlook. For publication in Oceans.
- Matsumoto, Walter M., and Robert A. Skillman. Synopsis of biological data on skipjack tuna, Katsuwonus pelamis (Linnaeus). For publication in U.S. Dep. of Commer., NOAA Technical Report NMFS Circular.
- Uchida, Richard N. The fish resources of the western central Pacific islands. For publication in FAO Circular.
- Hobson, Edmund S. Interactions between piscivorous fishes and their prey. Prepared for the Proceedings of the Predator-Prey Symposium to be presented by the Sport Fishing Institute, July 1978, Atlanta, Georgia.

HONOLULU LABORATORY

RESOURCE ASSESSMENT AND DEVELOPMENT INVESTIGATIONS (RADI)

Size Data From the Hawaiian Skipjack
Tuna Fishery Analyzed

One of the objectives of the Resource Monitoring and Assessment Task at the Honolulu Laboratory is to monitor the Hawaiian skipjack tuna fishery. Fletcher Riggs, Fishery Biologist, worked on the analysis of the size composition of the skipjack tuna landed in the Hawaiian pole-and-line fishery. During the preparation of the Honolulu Laboratory Administrative Report, "Descriptive statistics on the size composition of skipjack tuna, Katsuwonus pelamis, landed in the Hawaiian pole-and-line fishery, 1946-77,"

some minor discrepancies were noted in the data. The data base is being corrected and a more complete analysis of the data will be prepared for the 29th Tuna Conference to be held in late May 1978 at Lake Arrowhead, California.

Personnel in this task are often asked to provide summaries of tuna catches for various fisheries in the Pacific Ocean, information on activities of various kinds of fishing vessels, and comparable kinds of information that are not now resident in the Laboratory's data management system or are there but only in raw data form. To improve the Task's responsiveness to such requests for general types of fisheries information, work was started to select data sources for inclusion in the Honolulu Laboratory data management system. For example, certain summary data published by the Inter-American Tropical Tuna Commission in their annual report are being evaluated and the ADP unit will begin work to summarize data from the monthly reports of the Hawaii Division of Fish and Game. The ADP unit will shortly start designing the computer file for this information.

Mathematics of Markov Decision Processes Being Investigated

Dr. Roy Mendelssohn, Operations Research Analyst in the Fishery Management Research Task at the Honolulu Laboratory, has been working on the mathematics of a class of decision processes called Markov Decision Processes (MDP). The main difference between the models used in MDP's compared with standard population dynamic models, is that randomness is included in the model. Randomness may occur due to environmental variability or the inability to observe or measure aspects of the fishery with accuracy.

A second key difference, is that a policy may depend on the state, because the state in the future is not known with certainty. A state in an MDP is not just each species, say, but the level(s) of each specie(s) at each time period. An action is a feasible decision in each period--for example, the number to harvest or the level of fishing effort. A policy is a contingency plan of what action to take in each period for each state which might be observed.

MDP's find the "best" policy over all feasible policies. A policy is "best" in terms of a stated objective--maximize total expected (discounted) yield, or total expected yield subject to constraints or costs on year-to-year variations. Any finite MDP can be solved in a finite number of calculations. Finite, however, may be too large to be practical, even with modern computers. The number of calculations blows up with the number of states and the number of actions per state.

Research, therefore, concentrates on two areas: qualitative properties of optimal policies, and increasing computational efficiency for special class of models. Qualitative properties on an optimal policy describe the general form of the policy.

Several policies of this form can be tried as an ad hoc search procedure to find good, albeit suboptimal, policies. Increasing computational efficiency can take many forms. For example, some recent work shows that for a class of models relevant to harvesting problems, only two actions need to be considered at each state, without loss of optimality. This result makes it possible to solve very large problems with at most a minute or two of execution time on the computer.

Computational efficiency can also be increased by aggregating states and/or actions in the model, solving the reduced model, and "blowing" up this solution to the original model. This produces suboptimal policies, but bounds can be put on the loss. This makes it possible to explore efficient ways of aggregating and reaggregating to find better and better policies. An offshoot of this research is that choosing a grid size (number of fish, tons of fish, metric tons of fish, 10 MT (metric tons) of fish, etc.) is the same as aggregating or disaggregating states. A coarse grid can increase the relative variance of any two policies, compared to that of a finer grid. Other qualitative behavior of the population dynamics under a given policy will also be affected by the choice of the grid.

Finally, research is being done on "solving" MDP's having multiple, often conflicting objectives. Clearly there is no one solution, but it is possible to eliminate many policies from consideration. For example, if there are two objectives, eliminate any policy for which there is an alternate policy that does at least as well in one objective and strictly better in the second objective. It turns out that the research on more efficiently computing single objective MDP's also leads to more efficient procedures to "solve" multiple objective MDP's.

Activities Reported in Tuna Aggregating Device Project

Mr. Walter Matsumoto, Fishery Biologist, reported that trolling boat activity around the anchored objects set out by the Honolulu Laboratory declined during the month because of rough weather, the appearance of a drift log, and a drifting whale carcass in the waters off Oahu. Both the drift log and whale carcass attracted the bulk of the trolling fleet for nearly 2 weeks, providing the trollers with large catches of skipjack tuna and other large tunas. Nevertheless, the buoys were visited eight times and four additional boats were sighted on the buoys monitoring trip by the NOAA research vessel, Townsend Crowmell. The catches were small (five mahimahi, one striped marlin, and one spearfish), but a large bird flock (100-200 birds) was seen on two occasions at floating object C.

Late reports for February and reports from the first 2 weeks in March indicate that skipjack tuna boats had visited floating objects A and D eight times, catching nearly 10,000 lb of skipjack tuna and small yellow-fin tuna.

Two more objects were anchored off Kona, Hawaii for the benefit of sport and commercial fishing boats in that area. The objects were anchored about 5 miles offshore from Kaiwi Point, in 1,200 fathoms of water and 6 miles offshore from Mahaiula in 220 fathoms of water. Reports of fishing around these two buoys have already been received and more reports are expected, especially after the objects have aged a little.

A highly complimentary endorsement regarding D buoy was received from the trollers in Maui. The endorsement, completely unsolicited, included signatures of skippers of 16 trolling boats who requested more such objects closer to Maui and who promised to assist the Honolulu Laboratory in this program. This was followed up 2 weeks later by a visit to the Laboratory by Miss Sharman Brown, the Sea Grant College representative from Maui, to discuss the possibilities of having additional buoys set closer to Maui ports.

Townsend Cromwell Returns from Survey
and Assessment Cruise to Northwestern
Hawaiian Islands

The Townsend Cromwell returned to Honolulu after completing Part II (January 16-March 9) of Cruise 78-01, which was the fifth in a series of survey and assessment cruises to the Northwestern Hawaiian Islands (NWHI). The field party included Fishery Biologist Thomas Hida, Chief Scientist, and Research Assistants Glenn Higashi, Robert Humphreys, Martina Queeneth, and Darryl Tagami.

Hida reported that the highest catch rates of spiny lobster, Panulirus marginatus, were obtained at Midway Island. Of significance was the low catch rate at Necker Island, which is being heavily fished by commercial lobster vessels operating out of Honolulu. He also reported good handline fishing at French Frigate Shoals where 71 pink snappers, Pristipomoides microlepis, were caught in 2.5 h of fishing. Bottom and midwater trawl catches, however, were relatively poor.

Other missions of the cruise included exploratory dredging of precious corals for cooperating scientist Michael Palmgren, Hawaii Institute of Marine Biology (HIMB), University of Hawaii (UH), and inshore shark fishing for cooperating scientist Alan Kam, also of HIMB, who examined the shark stomach contents for remains of juvenile green sea turtles. The Cromwell also transported Brian and Patti Johnson from Midway Island to Laysan Island. The Johnsons are a husband and wife scientific team under contract to the Marine Mammal Division, Northwest and Alaska Fisheries Center, to study the Hawaiian monk seal at Laysan Island.

Other cooperating scientists on the cruise included Mr. Araha Vala, a fishery administrative trainee from Papua New Guinea and Mr. Craig Harris, U.S. Fish and Wildlife Service, who collected and brought back nine Laysan finches to Honolulu for study.

* * * * *

Dr. Robert A. Skillman, Coordinator, Tripartite Cooperative Study of the Northwestern Hawaiian Islands, met with participants in the study to develop a cruise plan for TC-78-03, July 24-September 25, 1978. A preliminary plan was submitted by the Hawaii Division of Fish and Game and some minor revisions to this plan were suggested by the U.S. Fish and Wildlife Service. The Honolulu Laboratory staff will prepare research activity plans in accordance with the plans of the other two agencies.

* * * * *

The Honolulu Laboratory's ADP unit is now in the process of developing a data file for data generated by the major field operations of the Insular Resources Task. The data file will be included in the data base management system in INFONET. As the ADP unit gains more experience with INFONET, other fishery data files will be added to the system. The Laboratory's Administrative Office is also using INFONET to access the SWFC's Financial Reporting System. With these projects in mind, a 4-day training session on INFONET to be given by Computer Sciences Corp. was arranged. The following staff members attended various sessions of the 4-day course: Michael F. Adams, Mary Lynne Godfrey, Gary L. Kamer, Sally H. Kuba, Roy Mendelssohn, Tamotsu Nakata, Fletcher V. Riggs, Robert A. Skillman, Ray F. Sumida, Darryl T. Tagami, Lucille T. Tsukano, James H. Uchiyama, Jerry A. Wetherall, Marian Y. Y. Yong, and Howard O. Yoshida.

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A preliminary Townsend Cromwell cruise schedule for FY 1980 and an amended schedule for FY 1979 were drawn up and distributed to the staff by the Honolulu Laboratory Vessel Committee, chaired by Dr. Skillman. These schedules will be evaluated by the SWFC Vessel Committee.

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Messrs. Hida, Higashi, Humphreys, Tagami, and Ms. Queenth participated in Part III of Townsend Cromwell Cruise 78-01 (March 13-19) together with University of Hawaii cooperating scientists Vernon Hu and Susan Rasmussen. During this part of the cruise, the Cromwell operated in waters off Hawaii, Maui, and Molokai and occupied trawling, trapping, handline, and plankton stations (neuston tows) for productivity studies in cooperation with the University of Hawaii.

* * * * *

Tamio Otsu, Chief, RADI, assisted Dr. Robert Kearney, Programme Coordinator for the South Pacific Commission, with arrangements to have a local skipjack tuna fisherman, Mr. Richard Kinney, assist in training SPC fishermen in Suva on the use of the Hawaiian bait net. Mr. Kinney agreed to a 2-week assignment in Fiji beginning March 24, 1978.

* * * * *

Personnel in the Insular Resources Task continued work related to the NWHI. Mr. James Uchiyama, Fishery Biologist, and Mr. Humphreys continued analyzing catch data obtained on cruises by the Townsend Cromwell and the Easy Rider (charter cruises). Research Assistant Paul Shiota continued to sort and take volumetric measures of plankton samples collected on Townsend Cromwell Cruise 77-02; he also conducted a literature search for information on handline fishing in Hawaiian waters. Robert Moffitt, Research Assistant, served as observer on the Easy Rider from February 24 to March 6 and departed in late March on another Easy Rider cruise.

Skipjack Tuna Landings Through March Remain Slightly Above Long-Term Average

The Hawaii landings of skipjack tuna in March were estimated at 86 MT, which is 11.0 MT below the landings for the same period in 1977 and 44.0 MT below the 1948-77 long-term average for the same period. The cumulative landings from January through March were estimated at 446 MT, which is 431 below last year's landings for the same period and 68 MT above the 1948-77 long-term average.

FISH-ENVIRONMENT INVESTIGATIONS (FEI)

Manuscript Describing Thermoregulation in Yellowfin Tuna Completed

A manuscript, "Physiological thermoregulation in yellowfin tuna," by Dr. Andrew E. Dizon, Leader, Experimental Ecology of Tunas, and Richard W. Brill, Graduate Student, was completed and sent to outside reviewers.

In the report, the authors present evidence for physiological control of body temperature by yellowfin tuna. A mechanism exists in these fish (and in skipjack tuna and probably other tunas) to control body temperature independently from activity-related heat production. Increased swim speed does not necessarily result in increased body temperature, although heat production within the body muscle mass is related to almost the cube of swim velocity. Since internal changes in whole body thermal conductance are required to interpret a decoupled body temperature/heat production relationship, physiological thermoregulation was hypothesized.

As for the hypothesized mechanism, red muscle can provide power at only minimum swim speeds, since it is located deep within the fish and thermally sequestered by circulatory heat exchangers. If it is required to propel the fish at slightly elevated speeds, lethal temperatures would result. White muscle must thus be considered an increasingly important power producer at speeds between minimum and burst. It has been shown

that white muscle in tunas (1) has significant aerobic metabolic capacity, (2) is active at the slowest swim speeds, and most importantly, (3) does not contribute to the thermal burden since no countercurrent heat exchangers serve this muscle. A tuna swimming with only white muscle power would not develop an elevated body temperature. The authors hypothesize that control of excess body temperature consists of fine-tuning the relative proportion of red versus white muscle input to the caudal "propeller." More red versus white muscle input to the caudal "propeller." More red muscle input results in a higher body temperature; less input, lower temperature.

An experiment has been initiated to test the hypothesis. A temperature-controlled water tunnel, 900 cm² in cross section and 120 cm long, which produces water velocities as high as 220 cm/sec, has been constructed for these tests. Initial experiments will examine the effect of ambient temperature on the swim velocity at which the tuna first employs its white muscle. Red and white muscle activities will be monitored using electrodes inserted into the respective muscle masses. If the tuna controls its body temperature by proportioning red and white muscle contributions, higher water temperatures should force the fish to utilize white muscle at lower swim velocities.

* * * * *

Heeny Yuen, Leader, Recreational Fisheries Task, began making preparations for yellowfin tuna tracking experiments in June. The yellowfin tuna will be tracked during the Hawaiian Invitational Allison Tuna Tournament and the Board of Directors of the Tournament is considering the possibility of providing a charter boat for Mr. Yuen's work. A portable hydrophone and control system suitable for small craft is ready for testing.

LA JOLLA LABORATORY

Coastal Fisheries Resources Division

COMMERCIAL AND RECREATIONAL FISHERIES RESEARCH FOR MANAGEMENT

Anchovy Plan Adopted by Council

During its meeting on March 9, the Pacific Fishery Management Council voted to accept the Anchovy Management Plan developed by the Coastal Fisheries Resources Division. In doing so, the Council chose to adopt the following management measures:

- (a) Closed fishing seasons for the reduction fishery:
 - (1) July 1 to July 31 and February 1 to March 31 north of Pt. Buchon;
 - (2) July 1 through September 14 and February 1 through March 31 south of Pt. Buchon.
- (b) Five ocean areas extending beyond the 3-mile territorial sea are closed to anchovy reduction fishing (same as under California law).
- (c) Size limit for anchovies landed for any purpose is 5 inches total length; up to 15 percent incidental catch of undersized fish is allowed.
- (d) Harvest Quotas. The annual anchovy harvest quota in the FCZ will be determined each year according to the following formula:
 - (1) When the estimated anchovy spawning biomass for the year is less than 100 thousand tons, no anchovy fishing will be permitted.
 - (2) When the estimated anchovy spawning biomass for the year is 100 thousand tons or greater, but less than 1 million tons, the harvest quota in the U.S. FCZ is 12,600 short tons.
 - (3) When the estimated anchovy spawning biomass is in excess of 1 million tons, the annual harvest quota will be equal to 12,600 tons or 23 percent of the biomass in excess of 1 million tons, whichever is greater.
 - (4) A portion of the harvest quota equal to 12,600 tons is reserved for non-reduction fishing only. Reduction fisheries will have an annual harvest quota equal to the overall harvest quota defined by 8.4.4(1), 8.4.4.(2) and 8.4.4.(3) less the 12,600 tons reserved for non-reduction purposes.
 - (5) A portion of the reduction fishery quota equal to 10,000 tons or 10 percent of the entire reduction fishery quota, whichever is less, is reserved for the fishery north of Pt. Buchon. The reduction fishery quota for the area south of Pt. Buchon is equal to the entire reduction fishery quota less the quantity reserved for the fishery north of Pt. Buchon.

The plan has been sent to the Secretary of Commerce for approval and implementation. The first fishing season under the new plan should begin on August 1.

Economic Impact Analysis for
Anchovy Plan Completed

Following the March meeting of the Pacific Fishery Management Council, Economists Jane McMillan and Dr. Daniel Huppert completed the final version of the Economic Impact Analysis for anchovy. Copies were sent to the Regional Office, the Council, and the Washington, D.C. office for review.

Cooperative U.S.S.R.-U.S. Hake Survey
Completed. Preliminary Results Indicate
Hake Biomass Somewhat Larger than in 1977

The 1978 cooperative U.S.S.R.-U.S. egg and larva survey for Pacific hake, Merluccius productus, was completed on March 23. The survey aboard the Soviet research vessel, Ogon, began February 27. The cruise was scheduled to begin in the south on line 110 and proceed north to line 67. Unfortunately, permission for Ogon to conduct fishery research in Mexico's 200-mile zone did not clear Soviet channels in time to sample the southern portion of the proposed survey. As a result, only 90 stations out of the 113 planned were occupied. Eleven stations occupied in Mexico's zone only surveyed the perimeter of hake spawning.

Shipboard scans of the plankton samples for presences of hake eggs and larvae, excluding the 11 stations off Mexico, found that 26.6% and 58.2% of the samples contained hake eggs and larvae, respectively. The estimated mean number of hake larvae per sample was 31.9 larvae. Comparable data for the shipboard scans of 1977 Ogon samples showed 63.4% of the samples contained hake larvae. The mean number of larvae per sample in 1977 was 24.2 larvae, somewhat less than for 1978. Comparison of the 1977 shipboard scan data with the actual counts after sorting indicated that shipboard scans were conservative with the percent of positive stations and mean number of larvae per station being underestimated by 17% and 51%, respectively. The preliminary results from the 1978 survey indicated that hake spawning was widespread, extending out to station 80 in southern California and out to station 90 north of Pt. Conception and that the biomass in 1978 may be somewhat larger than in 1977 by comparison.

Preliminary Management Plan
for Saury Completed

Dr. Gary Stauffer, Fishery Biologist, essentially completed the Preliminary Fishery Management Plan (PMP)/Draft Environmental Impact Statement for Pacific Saury during March. Additional editorial changes and re-typing will be completed and the PMP sent to Washington during April for review.

* * * * *

Method Developed for Predicting Annual Larvae Abundance of Anchovy

Keith Parker, Statistician, developed a method for predicting annual larval abundance of anchovy from winter and spring larval abundance. Annual abundance is regressed on winter plus spring for CalCOFI years from 1951 to 1975. Annual larva abundance is estimated via this regression. Annual spawner abundance can then be estimated from larval abundance by the method developed by Dr. Paul E. Smith and published in 1972. The regression estimate is good for annual biomasses above 500,000 tons. Below this level, it is not recommended that winter/spring larval surveys be used to estimate biomass.

The method developed here will be utilized in 1978 in computing the anchovy reduction fishery quota under the new Anchovy FMP.

Aerial Marine Resource Monitoring System Data Base

A milestone has been reached in the project according to Joe Caruso, Mathematician, who reports that the final coding of aerial survey data has been completed by Bob Scheldrup, Biological Technician. This means that all data for the years 1962-1977 inclusive have been computer coded. All data except 1977 data have been keypunched.

During the month of March another milestone was reached. Ten years of data, 1967-1976, have been verified and the first data base was created. Analysis of the aerial survey data may begin in the near future.

Rockfish Research Continues

Fishery Biologist John MacGregor reports that he examined olive rockfish (Sebastes serranoides) from Tanner Bank and the San Diego sport fishery this month. This species is one of the most frequently caught rockfish in the fishery. There appears to be no difference in growth rates between the inshore and Tanner Bank populations according to MacGregor. The inshore samples, 170 to 244 mm standard length, were estimated to be 3 to 7 years old. The Tanner Bank samples, 246 to 442 mm standard length, were estimated to be 7 to 25 years old.

The largest olive rockfish taken at Tanner Bank, at 442 mm standard length, was near the maximum size given for this species, 21 inches or 533 mm total length, by Phillips (1957). Since then, Miller and Lez (1972) have recorded a 24 inch (610 mm) total length specimen. Conversion of total length to standard length is $S.L. = .828 T.L.$

MULTISPECIES TAXONOMY PROGRAM

Fish Eggs and Larvae Reared for Study of Life History Series

A principal activity of the staff of the Multiple Species Taxonomy program at the La Jolla Laboratory continues to be the rearing of fish eggs and larvae for study of life history series. These experiments are being conducted by John Butler and Geoff Moser, with the help of other staff members.

Two specimens of the calico rockfish, Sebastes dalli, are still alive after 42 days. The largest preserved specimen has formed the anal, second dorsal and pelvic fins. The remaining specimens are larger and will provide a complete series of this rockfish.

A series of Paralichthys californicus, the California halibut, were reared to metamorphosis in 32 days. Mortality was close to zero. The series provided the first positive identification of the eggs of Paralichthys. Settling juveniles were presented with four substrate types, mud, fine sand, coarse sand, and shell. The juveniles showed a preference for fine sand in which they were able to bury themselves. Settling to the bottom at metamorphosis and finding the appropriate substrate may represent a critical stage in the life history of Paralichthys.

A sciaenid, possibly Genyonemus lineatus, the white croaker, is still being reared after 43 days. Over a thousand sciaenid eggs were collected on April 4, presenting the best opportunity to date for completing a life history series for croakers.

Larvae of the blue-banded goby, Lythrypnus dalli, were brought to the laboratory on April 3 by Chris Tierk of the Hubbs-Sea World Institute.

Work continues on identification of fish eggs and larvae taken in CalCOFI collections. Several biological observers assigned to the Porpoise/Tuna Interaction program have aided in sorting neuston net hauls samples collected during CalCOFI cruises in 1975 and have also helped in identifying and curating the fish reference collections of fish juveniles and adults.

The paper by Drs. G. Moser and E. Ahlstrom on the rockfish, Sebastes melanostomus, has been accepted for publication by the Journal of the Fisheries Research Board of Canada. The introductory text section for a CalCOFI Atlas dealing with the distribution and relative abundance of rockfishes on CalCOFI cruises from 1950 to 1975 is being prepared. With the completion of this Atlas, larvae of all the more common species taken on CalCOFI surveys of the California Current will be covered in the CalCOFI Atlas series. Already included in CalCOFI Atlases is information on the

distribution and abundance of the Pacific sardine, northern anchovy, jack mackerel, Pacific hake, 8 kinds of rockfishes and the most common meso-pelagic fishes (2 myctophids, 3 bathylagids, and 1 stenoptychid).

LARVAL FISHES, COASTAL EASTERN PACIFIC

Histological Examination of Anchovy Larval Continues to Determine Incidence of Starvation

Dr. C. O'Connell, Fishery Biologist at the La Jolla Laboratory, reported this month that he continued examination of histological sections of anchovy larvae to determine the incidence of starvation in a series of net tow samples taken in March 1977. As reported previously, a first round survey of 100 specimens indicated that while incidence of emaciation (starvation) was negligible for inshore stations, it was close to 20% for offshore stations, where abundance was also lower.

In a second group of 100 specimens now being examined, the incidence of emaciation, often severe, is about 17%. This cannot yet be allocated among inshore and offshore stations because the larvae are being examined without knowledge of their origin to avoid interpretive prejudice. These groups of larvae, which will include virtually all specimens from stations of low abundance, and a fair sampling from stations of high abundance, should be adequate for a first approximation analysis of starvation stress over the Los Angeles Bight area.

Delayed Feeding Experiments Repeated with Anchovy Larvae

Delayed feeding experiments with anchovy larvae (1000 eggs/100 liters) were repeated this month by Fishery Biologist G. Theilacker of the La Jolla Laboratory to obtain data on survival. Theilacker reported that anchovy reared at 15.5°C started feeding at the time of yolk absorption, four days after hatching. Survival at 13 days was: 1) 70% for the control, these larvae had fed 9 days ($\bar{x}$); standard length, 7.1 mm), 2) 20% when initial feeding was delayed three days after which the larvae were fed for six days (standard length 4.6 mm), and 3) 6% when initial feeding was delayed four days and then larvae fed for five days (to be measured).

During the first day of starvation, the larvae were observed to be active and buoyant, and remained in the upper part of the water column. However, by the third day of starvation, larvae were inactive and started to sink. Food was added after starving the larvae for three and four days after yolk absorption, and within a few minutes, larvae began to strike at food particles. It is thus conceivable that even when eggs are spawned in an area poor for first feeding, the larvae may sink or be transferred into a richer food area before dying of starvation, about seven days after hatching.

The possibility of identifying feeding and starving larvae at sea was investigated during the rearing experiments. Larvae were sampled and observed "live" (on a slide under a coverslip) using phase, bright-light, and polarized microscopy.

O'Connell has previously determined that the presence of zymogen (digestive proenzyme in the pancreas) identifies "healthy" anchovy larvae. In fresh mammalian pancreatic tissue, zymogen granules appear as bright, shining spheres under phase microscopy; however, the granules were not easily detected in "live" anchovy pancreas. Inclusions that occur in the posterior gut cells of feeding anchovy larvae were visible under phase in "live" larvae, but were also difficult to quantify.

Cartilage was another diagnostic characteristic which O'Connell used to classify larval anchovy. In "live" anchovy larvae, cartilage in the gills arches and cranial elements was easily located under bright-light and phase and presented a different appearance in fed than in starved larvae. In a feeding larva, the cell cytoplasm and nuclei were clear, and the cytoplasm filled whole cartilage compartments (lacunae). In starving larvae, the cytoplasm was granular and condensed, and nuclei were opaque. These diagnostic characteristics of cartilage were visible for about an hour in "live" larval whole mounts. After two hours, the characteristics had disintegrated, and healthy cartilage resembled the starved condition.

Theilacker also located the otoliths in these young "live" larvae with polarized light and counted daily rings. A larva fed for nine days (day 13, 7.1 mm) had 6 to 7 rings. A larva starved initially for three days and then fed for six days (day 13, 4.1 mm) did not have rings. According to Rich Methot, graduate student at the Scripps Institution of Oceanography who is studying otoliths, anchovy larvae do not start forming rings until they reach about 4 mm standard length. The otolith readings were checked by Methot in the "live" whole mounted larvae and again after dissection. He counted the same number of rings with both methods.

Theilacker believes that it may be possible to use this technique at sea to age and classify larval condition on station and to determine sampling procedure from the results. It would not be possible, however, to process the large number of larvae which would be required to obtain a valid sample of the area.

Work Continues on Analysis of Histological Estimates of Spawning Incidence in Northern Anchovy

Fishery Biologist Dr. John Hunter of the La Jolla Laboratory reports that work continued on the analysis of the histological estimates of incidence of spawning in the northern anchovy. Dr. Steven Goldberg of Whittier College has finished examination of eight in a total of 24 trawl samples collected by Ken Mais of the California Department of Fish and Game in

February of this year. These collections showed a striking homogeneity in incidence of spawning in samples collected from stations near La Jolla to ones near San Miguel Island and Santa Barbara.

The number of females spawning per night in these samples varied from 20-25%. As a check on past estimates of fecundity, the number of hydrated eggs in fish which had not spawned was counted in 10 specimens. This yielded an estimate of about 300 eggs/gram of female weight which is considerably below past estimates of fecundity. Further work is planned to check this fecundity estimate as it is a critical value in the model developed by K. Parker of the La Jolla Laboratory to estimate anchovy spawning biomass from spawning incidence.

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Dr. A. Alvarino, Fishery Biologist, reported that she completed sorting, identification, and measurement of fish larvae in a set of vertically stratified plankton collections taken on CalCOFI Cruise 6905-06). The objective of this work was to determine the extent of co-occurrence between fish larvae and various invertebrate predators. Twenty-five families of fish, representing 68 species, occurred in the collections.

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Dr. R. Owen, Fishery Biologist, assisted by Kathy Dorsey, Biological Technician, spent much of March on manuscripts which describe changes in concentration of larval fish food over distances 10 to 100 times less than are usually used to assay planktonic food supply.

A literature search was begun to collect all available information on vertical fluxes in the thermocline, especially those induced by wind, on the premise that there exists a critical flux beyond which microstructure of food can no longer persist, producing die-off by starvation of fish larvae that depend on such microstructure. Sources of increased flux other than wind stress include bottom friction, mid-water current shear in the presence of undercurrents and internal waves: these are also to be included in investigations to be conducted on factors affecting larval fish microhabitat.

Also under investigation is binding of food-sized organisms in aggregations ("marine snow"), making these plankters unavailable as food for larvae.

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Owen also began final editing of Koko Head plant pigment time series. A collaborative effort with B. Ito of the Center's Honolulu Laboratory, this 3-year record of bi-weekly observations will be analyzed by computer for characteristic time scales of change over periods of weeks to months

by spectral analysis, and for sources of change by correlation with sea temperature and salinity, winds and insolation, all of which were measured along with plant pigments.

Mexico and U.S. Continue
Informal Cooperative Research
and Data Exchange

On March 13 and 14, Dr. Reuben Lasker attended a joint Instituto Nacional de Pesca (INP)-California Cooperative Oceanic Fisheries Investigation (CalCOFI) meeting in Mazatlan, Mexico. Other members of the U.S. delegation were J. Reid, SIO; J. Radovich and H. Frey, CF&G; and R. Schwartzlose and G. Hemingway, SIO.

For some past years, INP and the agencies in CalCOFI have continued informal cooperative research and data exchange programs with the objective of providing a good scientific basis for the joint management of the living marine resources that occur off the west coast of both Mexico and the United States.

At this meeting the current CalCOFI year and the successful use of the Mexican ship, Humboldt, in CalCOFI surveys was discussed at length. The fate of the plankton samples, training of Mexican scientists in methods for estimating biomass and future meetings of the various subcommittees was on the agenda. It was agreed that training of a Mexican scientist would take place at the Southwest Fisheries Center in La Jolla during the crucial time of the anchovy biomass calculations in June or earlier.

The subcommittee on aging of fishes reported a general agreement on the method for aging anchovy. The problem of subpopulations was brought up by Radovich particularly in regard to differentiating between the central and southern anchovy stocks. It was agreed that the Subcommittee on Aging should address this problem when it meets again on April 7.

During a discussion of the Acoustic Subcommittee report the point was made that basic data from acoustic cruises should be available to anyone. At present, the only record is in cruise reports; it was agreed that the Subcommittee would look into this and solve the problem of data availability.

The Modelling Subcommittee has not met recently and has performed its work by correspondence. It was suggested that a meeting be held by the principals involved to discuss progress and future plans. The Catch-Per-Unit-of-Effort Subcommittee has not met for over 2 years and it was suggested that this Subcommittee be reactivated.

There was a discussion of the Anchovy Management Plan. The logistic curve of spawning biomass with time showing the estimated growth curve of

of the anchovy central stock was described by Radovich. He showed how this could be used to determine catch quotas. The division of larvae north and south of the border was illustrated in a SWFC Administrative Report by Dr. G. Stauffer of the La Jolla Laboratory and given to the Committee. It indicated that on the average 70% of all the larvae taken in CalCOFI cruises were found above the U.S.-Mexico border and 30% below.

On March 16, Division Leader Reuben Lasker chaired a meeting of Southwest Fisheries Center personnel on the work going on at the Center on the relation of climate to fisheries. A general plan of research was outlined which was useful during a climate and fisheries workshop on March 29-31 sponsored by the University of Rhode Island and NOAA's Environmental Data Service. Attending this meeting from the Southwest Fisheries Center were Parrish and Bakun of PEG, Monterey and Lasker and Laurs from La Jolla.

Oceanic Fisheries Resources Division

MARINE MAMMAL PROGRAMS

Research Chiefs Selected for Marine Mammal Programs

Director Barrett announced on March 26 that Dr. William Perrin had been selected to head the Marine Mammal Biology and Technology Program and Dr. Joseph Powers to be the leader of the Marine Mammal Assessment and Monitoring Program at the La Jolla Laboratory.

Perrin, previously leader of the Porpoise Biological Studies, has been associated with research on the porpoise/tuna interaction since 1969 and was one of the first scientists to focus attention on the problem of porpoise mortality in the tuna fishery. In this position, Perrin will be responsible for the conduct of several tasks required to define the biology (growth, reproduction, behavior, physiology, systematics) of porpoise stocks involved with commercial tuna fishing operations, and to develop fishing methodology that will reduce incidental mortality of porpoise.

Dr. Powers previously worked in the marine mammal program as Leader of the Porpoise Stock Assessment Task. His duties will include coordination and scientific contribution to the ongoing work of monitoring incidental mortality, estimating marine mammal population sizes, and determining the impact of fishery activities on the stocks of marine mammals, and maintaining the flow and content of data procured from NMFS field technicians.

First Research Cruise Completed Aboard Dedicated Tuna Vessel

The first research cruise aboard the tuna seiner, Queen Mary, dedicated by the U.S. tuna industry to research on the porpoise/tuna problem in the eastern tropical Pacific, ended on March 16 when the vessel arrived in San Diego. The primary areas of research during this cruise were acoustical studies, conducted by Dr. Frank Awbrey of San Diego State University, and fishing gear tests carried out by gear specialists from the La Jolla Laboratory.

On March 20 and 21, representatives of the Southwest Fisheries Center, the Marine Mammal Commission, Living Marine Resources, Inc. and the Inter-American Tropical Tuna Commission met at the Center to complete research plans for the second cruise aboard the Queen Mary. A joint decision was made to direct the primary efforts of this cruise to whole-school studies of dolphins. To accomplish this, a capture and holding pen apparatus has been designed, developed and engineered by James Coe of the technology project at the La Jolla Laboratory and engineers at the NMFS National Fisheries Engineering Laboratory in Bay St. Louis, Mississippi.

The porpoise impoundment system is designed to hook up to the backdown channel of the seine net and catch the porpoise as they are backed out. Once in the pen each animal is counted and examined to determine sex, length, color phase, and species/stock identification, thereby accumulating data on the structure and dynamics of the entire school. The actual count of porpoise in the school will also be matched against visual estimates for comparison.

Unfortunately, the whole school studies require special conditions, i.e., good weather and ideal school sizes. Since these cannot always be met, secondary goals were developed for the cruise. These are: 1) to perform necropsies on incidentally killed porpoise to look for symptoms of death which may have been induced by chase and capture; 2) to continue mortality reduction research; 3) to continue research on the feeding habits of porpoise, and 4) to collect blood samples from both live and dead animals for myopathy studies.

The second cruise of the Queen Mary, scheduled for 50 days at sea, is expected to begin from San Diego in early April.

Prototype Tags Tested on Captive Porpoise Found Unsatisfactory

Jackie Jennings, Leader of the Porpoise Tagging Project at the La Jolla Laboratory, and Dr. Warren Stuntz, Fishery Biologist, traveled to Hawaii in mid-March to test the dorsal disc tag on six captive Hawaiian spinner porpoise. They found that the machined prototype tags did not work out well, mainly because the teflon material used was not rigid enough. The plan now is to use polyurethane tags.

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David Holts, gear specialist in the Technology Project, was in Panama for a week this month to assist with the installation of super aprons aboard the tuna seiners, Royal Pacific and King Oscar. Two additional super aprons were also installed aboard the Bold Phoenician and Maria C. J. during their period in port in San Diego recently.

Planning Continues for Conference
on Age Determination Scheduled at
Southwest Fisheries Center

Second announcements have been distributed by Dr. William Perrin and Albert Myrick of the Southwest Fisheries Center to attend the first international conference for determining age in odontocete cetaceans (dolphins, porpoises and toothed whales) which is scheduled to be held at the Center in early September 1978.

The purpose of the conference is to bring together cetologists currently working on the life histories of odontocetes, and workers in other related fields, who can be expected to contribute to a potentially integrated approach to the problem, e.g., fields such as mammalian nutrition, physiological chemistry, crystallography, and age determination of other mammals. The conference will have two parts: a three-day symposium and a 10-day workshop.

Technique Developed to Determine
Visible Layers in Tooth Structure
of Dolphins for Age Determination

Albert Myrick, Wildlife Biologist at the La Jolla Laboratory, reports that he has now developed a technique to determine visible layers in the enamel and prenatal dentine of dolphins that may be recorded on a daily time increment. According to Myrick this process will hopefully be used to determine gestation periods in Stenella spp. Myrick is also beginning work on layering in the bones and teeth of known age bottlenose dolphins, Tursiops truncatus, reared in captivity. The data collected from these studies will be used to calibrate layer deposition rates in other odontocetes for age determination.

TUNA RESOURCES PROGRAM

Sampling of Foreign Caught Atlantic
Tunas is Reported for 1977

A summary report on the 1977 Puerto Rican sampling program has been completed by Eugene Holzapfel, Al Coan, Earl Weber, and Jim Renner of the Tuna Resources group at the La Jolla Laboratory. Biological Technician

Holzappel returned to La Jolla from Puerto Rico this month to discuss results of the sampling of imported tunas entering the ports of Mayaguez and Ponce, Puerto Rico.

During 1977, 137 samples involving 5797 fish were collected to determine the length-frequencies of yellowfin (55 samples), skipjack (50 samples), bigeye (26 samples) and albacore (4 samples). Sixty-seven of these samples were used to estimate the percentage of bigeye being imported as yellowfin tuna, since these species are reported together. Results indicated that 35% of tuna imported as yellowfin are actually bigeye tuna.

Additional samples involving approximately 200 fish were collected to establish length-weight relationships for yellowfin, skipjack, and bigeye tunas. Results differed from previous analysis indicating a need for increased sampling.

Otoliths were taken from 121 skipjack tunas. To date eight have been aged and these fish show a faster growth rate than had been previously assumed for Atlantic skipjack.

Special experiments were conducted to detect biases in the sampling program. One experiment showed that a trained technician can distinguish between small yellowfin and bigeye using external characteristics only. This is routinely done by dissecting the fish and using morphological differences of the liver for identification. Another experiment showed the proportion of broken yellowfin and broken bigeye are equal and that discarding broken fish from a sample does not bias the species composition.

Tuna Seiners Continue Participation in Laboratory's Fax Program

During March 1978, 23 tuna seiners participated in the FAX Advisory Program of the La Jolla Laboratory. The tables below reflect March data for 1976, 1977 and 1978 and the first quarter summary data for the same years.

MARCH REPORTING RATES

Year	Vessels With Equipment	Vessels With Observations	Weather Observations	XBT Observations	Monthly Total	Year To Date
1976	73	30	239	16	255	785
1977	60	4	57	0	57	455
1978	54	23	208	21	229	714

FIRST QUARTER REPORTING RATES

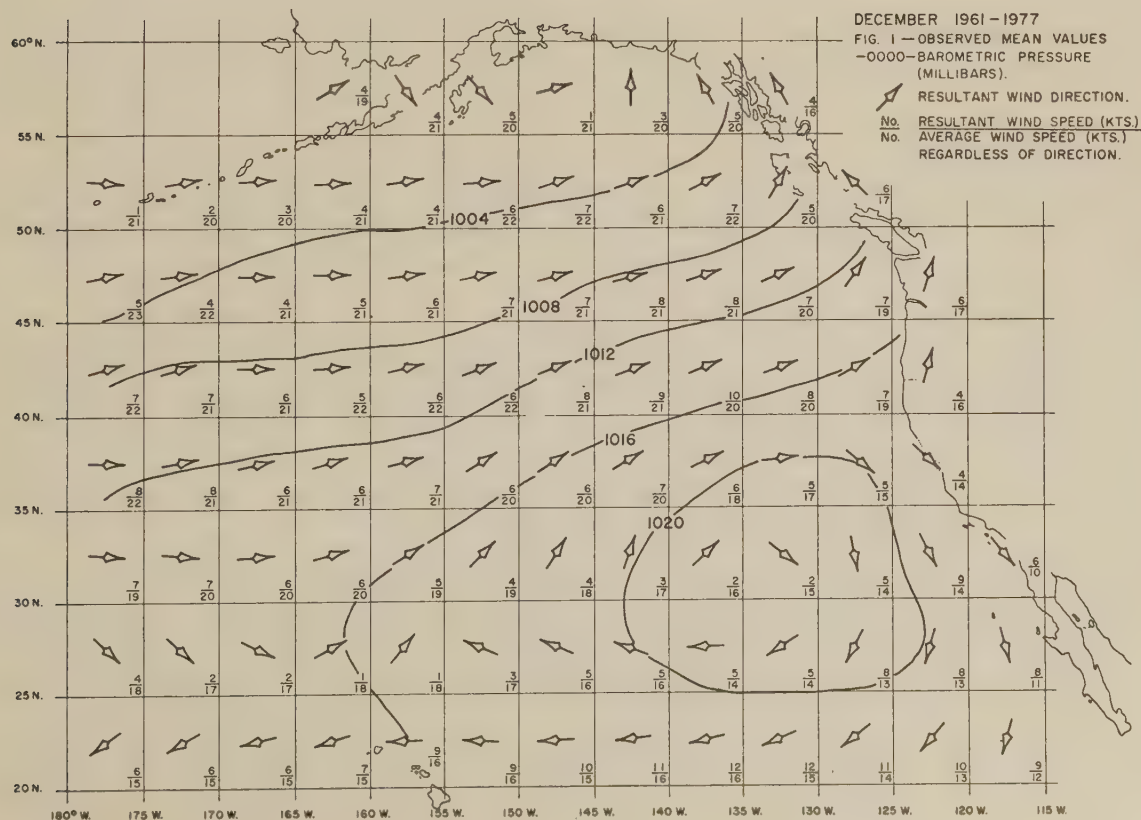
Year	Vessels With Equipment			Vessels With Observations			Weather Observations			XBT Observations			Monthly Total		
	Jan	Feb	Mar	Jan	Feb	Mar	Jan	Feb	Mar	Jan	Feb	Mar	Jan	Feb	Mar
1976	73	73	73	31	32	30	136	327	239	28	39	16	164	366	255
1977	65	63	60	20	22	4	185	203	57	5	5	0	190	208	57
1978	54	54	54	20	27	23	163	263	208	10	49	21	173	312	229

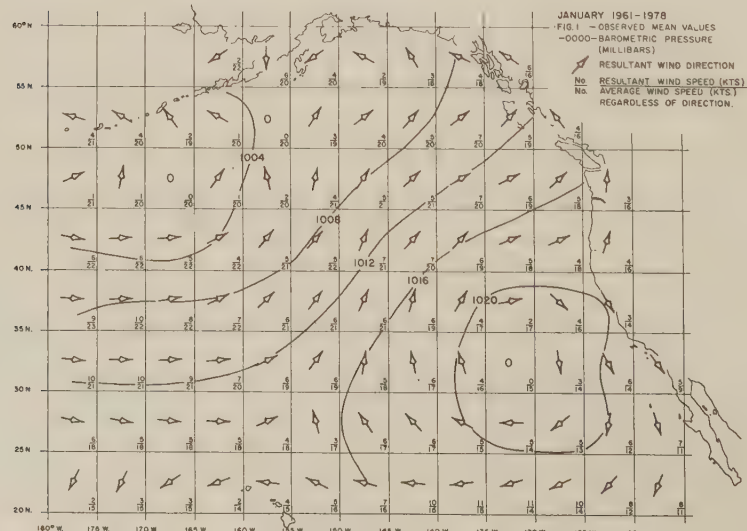
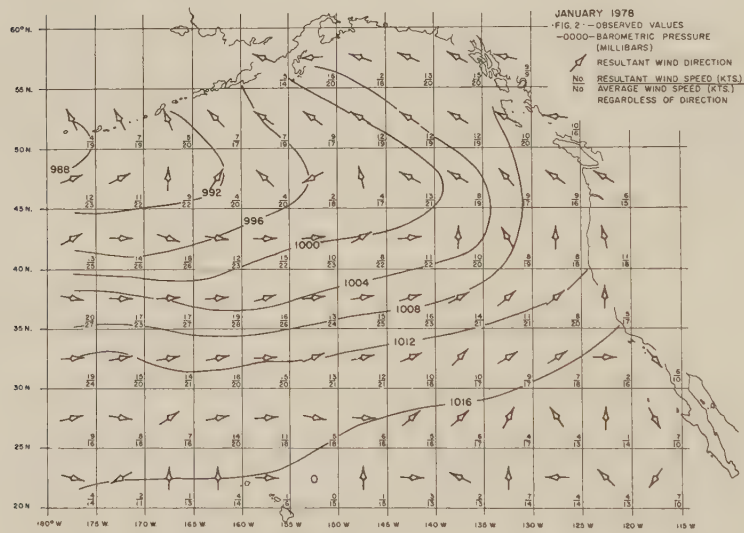
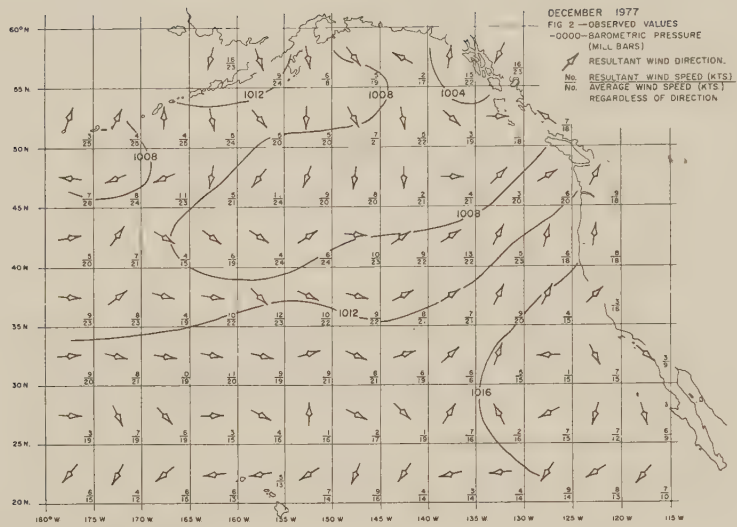
The decrease in observations from February to March 1978 reflects the fact that many vessels have been in port unloading their catches and attending to repairs. During March 1977, many vessels remained in port during the controversy regarding the porpoise regulations and hence the reporting rates were extremely low.

The tuna seiner, Santa Rosa, leads this month's participation with 18 weather observations and 7 XBT observations

Significant Changes in Weather Patterns Reported in Fishing Information

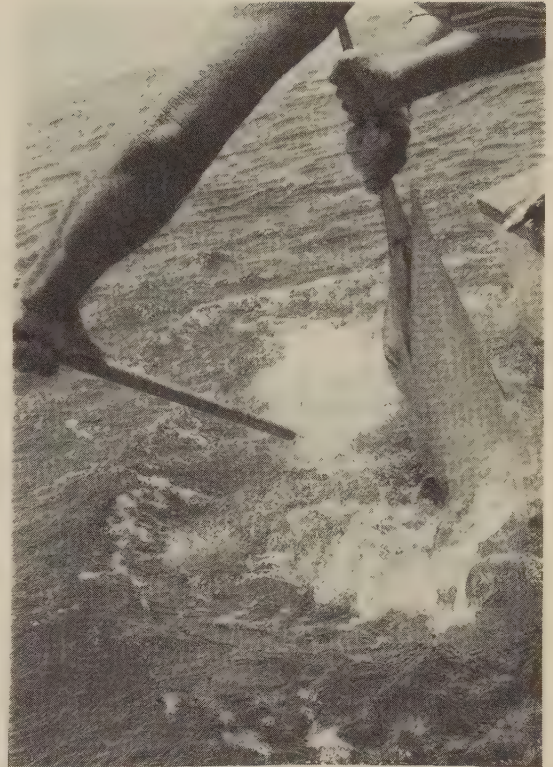
Fishing Information, a monthly report from the Southwest Fisheries Center to the tuna fishing industry, meteorologists and marine scientists, shows a marked change in weather patterns during December 1977 and January 1978 (see accompanying figures). The report is provided in booklet form every month, edited by James A. Renner, Fishery Biologist, and is updated with a supplement every 15 days. It contains information for portions of the Pacific on sea surface temperatures, barometric pressure, wind velocity and a temperature and salinity profile between Honolulu and San Francisco. Many of the recipients provide the Center with valuable environmental and fisheries information which is used in developing data bases from which this document and other research materials are provided. Approximately 800 people receive this publication that has been produced by the Center since 1960.





Results of 1977 Cooperative Marine Game Fish Tagging Program Available

James Squire, Fishery Biologist at the La Jolla Laboratory, who has been in charge of the Cooperative Marine Game Fish Tagging program for the Pacific since its inception, reports a major change in the tagging program in 1977. In past years, the state of New South Wales Fisheries (NSWF), Australia, has provided limited support to the program for tagging and releasing black marlin off Cairns, Australia, using a limited number of their own design tags. In 1977, Dr. Julian Pepperell, Director of the NSWF tagging program, has taken over responsibility and support for Australian tagging. The NSWF tags now being distributed are manufactured in the U.S. and are the same type as supplied world-wide by the National Marine Fisheries Service. NSWF tags have been used for about 60% of the black marlin tagged in 1977. According to Squire, Australia's participation in support of the cooperative billfish tagging program will provide increased knowledge of the important sport and commercial black marlin resource in the southwest Pacific. The New Zealand Ministry of Agriculture and Fisheries also participates in this cooperative program, as it has for some years.



Another development of interest is the increase in the number of blue marlin tagged and released off the Kona coast of Hawaii in 1977. The 52 fish which have been tagged and released represent a several-fold increase in the number of blue's tagged over previous years.

In 1977, 927 billfish were tagged by cooperating marine anglers. Of this number striped marlin (Tetrapturus audax) accounted for 417 or 45% of the total billfish tagged. Black marlin (Makaira indica) with 339 tagged accounted for 37%. Sailfish (Istiophorus platypterus) accounted for 108 or 12% of the tagging total and 62 black marlin (Makaira nigricans) for 7% and 1 shortbill spearfish (Tetrapturus augustirostris).

The number of fish tagged under the auspices of this program in 1977, including the 927 billfish, totaled 1,122. Other fish species tagged were roosterfish, dolphinfish, yellowtail, sharks, wahoo and sturgeon. Cards and recoveries received after January 1, 1978 will be included in the tagging report total for 1978.

PACIFIC ENVIRONMENTAL GROUP

OCEAN MODELING AND FORECASTING

Recent Anomalies Noted in Winter
Atmospheric Forcing of Near-Coastal
Processes in the California Current

Andy Bakun and Dick Parrish of PEG report that the past two winters have represented very opposite extremes in terms of the wind stress acting on the ocean surface, which is the major forcing mechanism for ocean circulation and related processes such as upwelling and turbulent mixing. Off California the winter of 1976-77 was a consistently relaxed low-energy situation while the winter of 1977-78 was marked by very intense, highly fluctuating wind stress episodes.

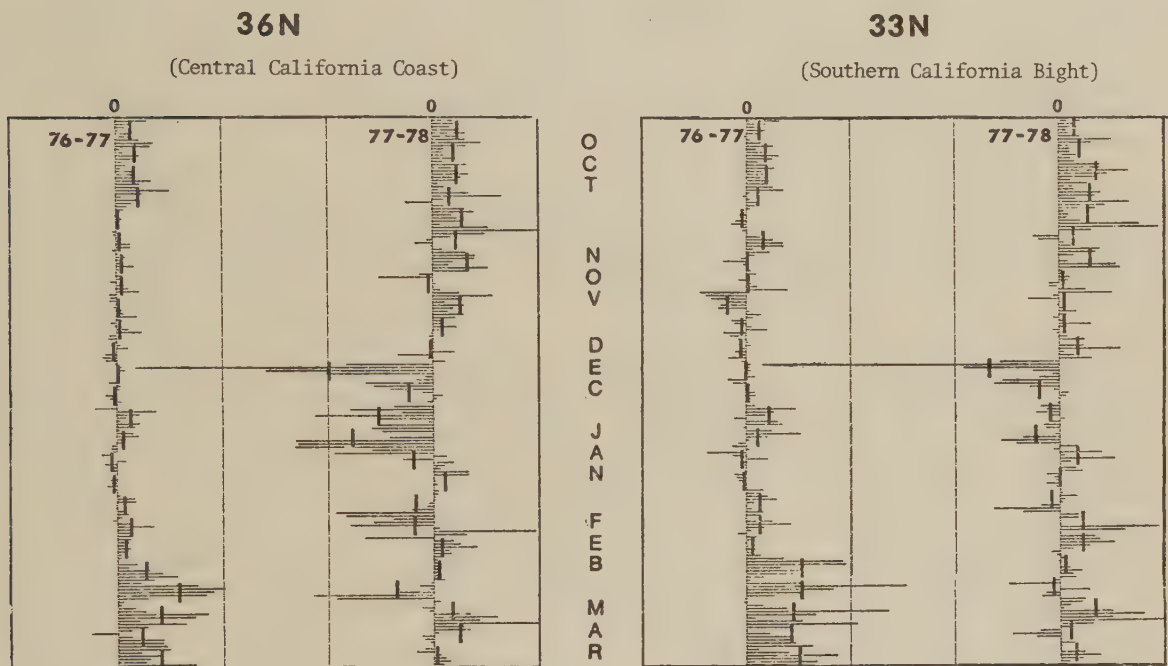
The accompanying figure displays daily and weekly means of 6-hourly upwelling index computations¹ at two locations off central and southern California. Positive values, extending to the right of the zero line, represent southward upwelling. Negative values, extending to the left, indicate northward alongshore stress, onshore transport, coastal convergence and downwelling. The extremely slack conditions from November to February of 1976-77 are apparent, particularly in the graph for the 36N latitude location. In this situation organisms would have been subjected to much lower than normal levels of onshore and offshore excursions of surface waters, and of turbulent mixing and related dispersion of planktonic aggregations. One possible result of these benign conditions is the reported appearance of unusual numbers of juvenile rockfish in the summer of 1977.

During 1977-78, in marked contrast, intense storm events followed one another in rapid sequence. The indicated onshore-offshore excursions would have made it difficult for planktonic larvae to remain in favorable bathymetric depth ranges. Strong turbulent mixing would have tended to destroy patch structure in the plankton. Similar index computations at other locations during the period indicate anomalous coastal convergence throughout the California Current region; such piling of surface waters against the coast would tend to induce northward alongshore flow and resulting anomalous warm advection.

The contrast between the two winters illustrates the fact that the mean value of a given process over a given monthly or seasonal period may be less important than the frequency content within that period. Over

¹Bakun, A. 1975. Daily and weekly upwelling indices, west coast of North America, 1967-73. U.S. Dept. Commer. NOAA Tech. Rep., NMFS SSRF-693, 115p.

certain time scales averages of these upwelling indices would have yielded similar (near zero) mean values, although averaged biological effects would be very different. The staff of the Ocean Modeling and Forecasting task at PEG is concentrating on developing methods for describing variations not only in the seasonal amplitudes, phases, and durations of crucial environmental processes, but also in the underlying spectral characteristics which may be the factors actually determining successes or failures in certain stages of the life cycles of fishery species.



Daily and weekly means of 6-hourly upwelling index computations. Horizontal lines indicate daily mean values; vertical bars indicate weekly mean values. Values to the right of the zero line indicate offshore surface transport and upwelling; those to the left indicate onshore transport and downwelling.

TIBURON LABORATORY

FISH COMMUNITIES INVESTIGATION

Seasonal Change in Food Habits of the Blue Rockfish Tied to Regular Environmental Changes

The blue rockfish, Sebastes mystinus, one of the major rockfishes in the northern California fishery, has well defined seasonal changes in its food habits that correlate with seasonal environmental conditions. James Chess, Fishery Biologist with the Fish Communities Task at the Tiburon Laboratory, this month completed analyzing the gut contents of specimens of blue rockfish that he and Dr. Hobson, Project Leader, collected during the past year.

Adult blue rockfish living in the kelp (Nereocystis) forests are omnivorous, being primarily herbivorous for a part of the year, and primarily planktivorous for the other part. This pattern is largely controlled by two seasonal phenomena. During the winter offshore water flows shoreward as coastal upwelling ceases. This offshore water brings with it large numbers of gelatinous zooplankters, e.g., scyphozoans, salps, heteropods, which become the major food of adult blue rockfish when they are present. These organisms are largely unavailable during late summer and fall, however, because the waters carrying them are blocked from the nearshore habitats when coastal upwelling resumes. At this time the Nereocystis plants produce their reproductive tissue, or sorri, which drop from the plants and drift to the bottom. Under these circumstances these sorri replace the zooplankters as the major food of the blue rockfish.

FISHERIES DEVELOPMENT INVESTIGATION

Industry Enthusiastic on Prospects for Development of Domestic Hake Fishery

Sus Kato, Task Leader, traveled to Eureka, California, March 17-19 to attend a workshop on the development of a domestic hake fishery, hosted by Sea Grant and Tom Lazio Fish Company. The meeting was attended by around 120 persons including fishermen, processors, fish retailers and researchers. Enthusiasm was high among industry members, but according to Kato it remains to be seen whether the problem of fast spoilage of hake can be overcome.

After the meeting Kato participated in Sea Grant gear workshops held at Eureka, Crescent City, and Ft. Bragg on March 20 and 21. Kato explained fishery development projects of this laboratory, while Gary Loverich of

Seattle Marine Supply discussed new ideas in net design. Kato said it was refreshing to learn that fishermen at the various ports are actively looking into new fishing methods. Pair trawling in midwater with large nets was discussed in detail, and several fishermen have already ordered such nets. The Tiburon Laboratory hopes to get involved in the development of this and other new methods.

Delivery of 100,000 King Salmon Scheduled at Tiburon

Roger Green, Fishery Biologist, reported that plans to nose-tag 49,000 king salmon at Feather River Hatchery at the end of this month were canceled because of the small size of the fish. The revised schedule calls for machine tagging of these fish next month by the California Department of Fish and Game and delivery of the lot--100,000 king salmon--in late April or early May. They will be held here until release in mid-June. The use of the magnetically encoded nose tags with adipose fin clips will insure that the return data will be collected and processed within the Department of Fish and Game's statistical sampling system. This will enable a direct comparison between the laboratory's rate of return with those of fingerling and yearling hatchery releases.

Tag returns, this month, consisted entirely of fish from the laboratory's only king salmon release from the fall of 1976. Twelve tags were returned by March 29. The rate of return is now more than double that of any of the releases of coho salmon. The kinds average around five pounds and all were from the ocean fishery.

Fishery Biologist Dan Ralph fabricated the morphaline-releasing drip apparatus this month and will test the outfit for controlling flow rates next month. Both the king and coho salmon releases, scheduled this year, will be subjected to imprinting experiments to modify their homing upon return.

Several computer runs of tagging and return data from previous releases were completed this month and are presently being analyzed.

San Francisco Bay Fisheries Paper Revised

During the month, revisions were completed on the bay fisheries review paper and the manuscript returned to the editor under the new title "An Historical Review of the Factors Affecting the Fish and Fisheries of the San Francisco Bay System."

Publication of Anglers' Guide Begins

With the establishment of a \$7.50 per copy price for the Pacific Anglers' Guide, distribution of the book was begun. Publicity from an article which appeared in the April issue of Sunset Magazine and in a public information effort which is being carried out by the NMFS National Fishery Education

Center should result in a large demand for this book. Copies of this publication can be obtained by writing the: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, requesting the Department of Commerce, National Marine Fisheries Service, Special Publication, "Angler's Guide to the United States Pacific Coast," stock number 003-020-00113-1.

PHYSIOLOGY INVESTIGATIONS

Striped Bass Research Reviewed

A meeting was convened at the Tiburon Laboratory March 2 to present and discuss results of experiments conducted the last two years on factors affecting mortality in striped bass eggs and larvae. Attending the meeting were representatives from the Delta Fish and Wildlife Study and the Central Valley Hatchery of the California Department of Fish and Game, the U.S. Bureau of Reclamation, NMFS (Washington, La Jolla and Tiburon), the University of California at Davis, and Tetratex Corporation. The presentation covered a wide range of subjects with emphasis on a conceptual mortality model, electrophoretic studies, potential effects of special physiological ions, bioenergetics, and food and feeding factors as they relate to larval survival and development. In discussions many results were found to agree with observed field and hatchery conditions, and input was given to those subjects which need elaboration and/or further study.

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Preparations are under way for the upcoming experimental season. Activities are planned in three major areas: 1) physiology and morphology of spawners and post-spawners, 2) effects of different waters and their ionic compositions on fertilization, embryonic development and survival, and 3) food and feeding variables and metabolic rates in larvae. The results of the larval feeding studies should provide the information needed to complete the bioenergetic studies of the embryonic and larval stages as they relate to a standard food source (*Artemia*). We anticipate subsequent studies in the latter part of the season which will use wild plankton. Larvae feeding relationships and their associated energetics with wild plankton will then be determined.

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Jeannette Whipple, Task Leader, and Mickey Eldridge visited California Department of Fish and Game in Stockton on Wednesday, March 15, to discuss sampling of adult striped bass during their spawning season in the Delta. The collection will be made with CDF&G personnel in conjunction with their annual tagging program. Fish will be brought back to Tiburon Laboratory for a complete autopsy and analysis of a number of morphological and physiological parameters relating to inherent and genotypic variability in adults and their gonadal gametes at spawning time.

Oil Pollution Studies

Jeannette Whipple completed a review of the EPA redbook criterion document on toluene. Recommendations were made to lower the criterion concentration levels for toluene. Information and publications were also sent to Dora Passino of U.S. Fish & Wildlife Service (Contaminant Toxicology Program) in Ann Arbor for her review of the criterion document on benzene. In view of research done at Tiburon Laboratory, Dr. Passino recommended in her review that the water quality criteria for benzene also be lowered.

Tissue Sample Processing for Food Chain Studies Completed

Tissue sample processing for food chain and clam uptake studies was completed one month ahead of schedule. Analyses of the tissue sample extracts began this month; to date, 240 of 315 extracts have been analyzed for 23 petroleum hydrocarbons (sylene isomers through substituted naphthalenes). Analyses of 280 of 330 tissue extracts for 12 low-boiling petroleum hydrocarbons (methylcyclohexane through xylene isomers) were completed to date.

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A manuscript describing uptake of substituted cyclohexanes from food and water by starry flounder was started this month. The paper will describe new techniques developed by Tom Yocom, Pete Benville, Jr., and Ross Smart to analyze tissues for low-boiling compounds; the paper will also describe their subsequent discovery of high concentrations of substituted cyclohexanes in tissues of starry flounder. These compounds were biomagnified to high ppm concentrations in flounder tissues from low ppb concentrations in food or water. Commonly used analytical techniques would boil off these compounds and thus, cyclohexanes were not previously identified as biologically important compounds in the water-soluble fraction of crude oils. Five other manuscripts are in preparation and one is in press.

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Responsibility of ADP Group at Center Expanded

To provide accurate, efficient, and timely computer services and systems in support of the Center's expanding research programs, sophisticated data management and processing systems have been evolved at the Center. Data Systems Manager Fred Kellenberger, assisted by Systems Analyst Dorothy Roll and a staff of programmers and technicians, are responsible for design, programming, implementation, and maintenance of the various computerized systems.

This month Rich Charter, formerly a data editor for the porpoise/tuna program, was selected as the manager for the CalCOFI data management system and began training under Roll and her staff.

To manage the logistics of the processing flow of the numerous data sets, two charts were designed and are in use. The data traffic progress chart is a capsule report which shows the posted date for completion of specific activities during the processing of cruise data. The flow diagram charts the input and output file interaction during the edit and update processing of CalCOFI information.



The 7712 Humboldt cruise data were used to test the completed programs and to formulate standard validation procedures between users and the ADP unit. Minor changes are being made to correct program logic errors and to eliminate ambiguities in the error audit trails.

Roll reports that selected priority stations for the Jordan and Humboldt (stations of significant biological indicators) are in the edit phase. Sorter tallies for these selected stations have been punched and verified. Tow data for Cruise 7803 for the Jordan, Humboldt, and the Soviet research vessel, Ogon, have been punched, verified and processed by the PRETOW program which produces the plankton volume record collection form.

An update on the Orientation and Development notes on the CalCOFI management system is being written. Completed for the package are revised card formats for all the data sets and thorough key punching instructions for all elements within each data set.

In addition to processing data taken during the current CalCOFI year, work also continues on transformation of past CalCOFI data into computer compatible form. Update of the biological sized-twenty file with late 1969 and 1972 data is completed. Source data for those cruises were screened by edit routines during the processing by the CDC 3600 and B6700 computers. Data for 1975 cruises are in the edit/validation and computation phase in preparation for update on the master file.

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According to Kellenberger, work is also in progress on a number of other data systems--the Financial Reporting System, Predator Data Management System, Northwestern Hawaiian Island Survey Data Management System, and others. A report of progress on these and other systems will be made in the Center Monthly Report from time to time.

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On March 27, Dr. R. Lasker chaired a meeting of an ad hoc committee at the Center which had been designated by Director Barrett to review the activities of the Automatic Data Processing group.

HONORS AND AWARDS

Service to Mankind Award Presented Jointly to NMFS Employee and Wife

Members of the Sertoma Club of San Diego, an international service organization with more than 33,000 members in the U.S., Mexico and Canada presented their annual Service to Mankind Award jointly to Henry and Elvia Orr of El Cajon, California on February 25. Orr is a Scientific Illustrator at the National Marine Fisheries Service, Southwest Fisheries Center in La Jolla, California, a position he has occupied since 1972. At the award dinner, letters of congratulation were read from the mayors of El Cajon and San Diego and from Izadore Barrett, Director of the Southwest Fisheries Center.

The Orrs were honored for their work with severely handicapped people. Elvia puts in many volunteer hours as a sitter for handicapped children and adults. She also teaches English and Spanish reading and writing to elderly and illiterate poor at Edgemoor Geriatric Hospital in San Diego. Henry is actively involved with Recreational Services for the Handicapped and IMPACT (Involvement of Mexican Populace in Active Community Tasks), a non-profit social service agency. He has also frequently volunteered his services as a draftsman for a company producing prosthetic devices for the handicapped.



Pictured Left to Right: Top: Gil Evans (sponsorship chrm), Ted Saur (co-chrm and ex-NMFS), Bob Mark (Pres.) & Izadore Barrett (Dir., SWFC). Bottom: Ms. Frances Orr, Ruben Ochoa, Elvia Orr, Henry Orr.

In 1976, Henry and Elvia took into their home two young Mexicans, Juan Navarro, 27 and Ruben Ochoa, 17. Both young men had tried to cross into the U.S. illegally and in the process received serious injuries which will probably prevent either man from ever walking again unaided. Elvia taught both men reading and language skills while Henry coordinated their job training so that they may be self-supporting on their return to Mexico. Navarro recently left for Mexico, Ochoa continues to live with the Orrs.

Orr is himself severely handicapped and completely confined to a wheelchair. As an infant his Mexican mother brought him to the U.S., critically ill with polio, to seek medical help. When his mother was forced to return to Mexico, Orr was placed in a receiving home in the U.S. and later adopted by an American nurse. He grew up with atrophied lower limbs and only one fully functioning hand and arm.

La Jolla Laboratory

James Zweifel, Mathematician, received a 15-year length of service pin.

Eric Lynn, Biological Technician, Coastal Fisheries Resources Division, Quality Step Increase.

James Coe, Fishery Biologist, Cash Award.

Tiburon Laboratory

David R. Smart, Special Achievement Award.

Edmund S. Hobson - The cover of the March-April issue of American Scientist shows a school of butterfly fish, Chaetodon lunula, rising above a Hawaiian reef. This color photograph, accompanying an article entitled, "Schooling Fishes" by Evelyn Shaw, was taken by Dr. Hobson, Fishery Biologist at the Tiburon Laboratory and widely recognized as one of America's foremost photographer of fishes in nature.

RECENT ADDITIONS TO SWFC STAFF



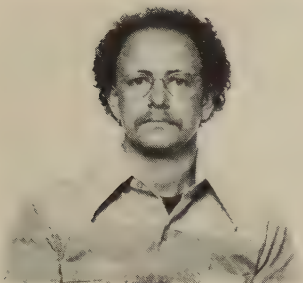
JANE A. McMILLAN - EOD 8-28-77

Industry Economist - Commercial and Recreational
Fisheries Research for Management, Coastal
Division, La Jolla Laboratory



ALBERT C. MYRICK, JR. - EOD 8-14-77

Wildlife Biologist - Life History and Systematics,
Oceanic Division, La Jolla Laboratory



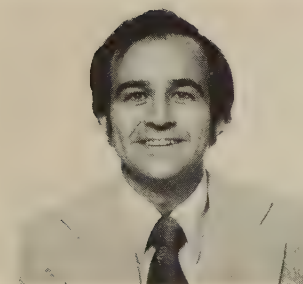
WAYNE L. PERRYMAN

Lieutenant, NOAA Corps, Assigned to Stock
Assessment Program, Oceanic Division, La Jolla
Laboratory



MARY K. PIERCE - EOD 1-29-78

Clerk Typist - Support Services,
La Jolla Laboratory



RONALD G. RINALDO - 12-4-77

Fishery Biologist, Global Tuna Fisheries Analysis,
Oceanic Division, La Jolla Laboratory



THOMAS B. SHAY - EOD 10-3-77

Biological Technician, Behavior and Physiology
Program, Oceanic Division, La Jolla Laboratory



WARREN E. STUNTZ - EOD 1-15-78

Fishery Biologist, Behavior and Physiology
Program, Oceanic Division, La Jolla Laboratory



EARL C. WEBER - EOD 6-19-77

Fishery Biologist, Global Tuna Fisheries
Analysis, Oceanic Division, La Jolla Laboratory



KENNETH E. WALLACE - EOD 10-11-77

Biological Technician, Quantitative Analysis
and Data Analysis, Oceanic Division,
La Jolla Laboratory

SEMINARS

La Jolla Laboratory

- March 13 - Dr. Nancy M. Moffatt, NOAA Post-Doctoral Research Fellow, Southwest Fisheries Center discussed, "Oxygen and yolk conservation during embryonic development of the grunions."

PUBLIC AFFAIRS

- March 1 - Dr. Eric Barham, Oceanic Fisheries Division, discussed the past, present and future of the porpoise/tuna problem before 225 students from California State University at Long Beach, California. The host professor was Dr. Charles Galt.

- March 6 - Dr. E. Hobson, Tiburon Laboratory, gave a talk to the docents of the California Academy of Sciences on California Fish Communities during their visits to the Tiburon Laboratory. Staff members of the Physiology Investigation then guided the docents on tours of the Physiology Laboratory.
- 30 - Ed Ueber, Tiburon Laboratory, gave a talk on Economics of the Fishery to a Population Dynamics class at San Francisco State University.

MEETINGS AND TRAVEL

- March 2 - Director I. Barrett in Tiburon, California to attend a meeting on striped bass research.
- D. Mackett, Program Planning Officer, in Terminal Island to attend a meeting on data "confidentiality" with the staff at the Southwest Region.
- Economist D. King traveled to Terminal Island to obtain information on global processing and transshipment of tuna products.
- 5-9 - Mackett and F. Kellenberger, Data Systems Manager, traveled to Las Vegas to attend a Data Communications Conference.
- 6 - Barrett and Dr. M. Laurs traveled to Monterey to attend a meeting on fishery oceanography.
- 6-8 - Dr. W. Lenarz, Tiburon Laboratory, attended a meeting of the Groundfish Management Plan Development Team at Menlo Park.
- Ed Ueber, Tiburon Laboratory, attended a meeting of the Pacific Management Council at Sacramento.
- 7-10 - Drs. D. Huppert and G. Stauffer in Sacramento to attend the Pacific Fishery Management Council meeting.
- 8 - H. Uchida participated in a meeting with Drs. Y. Hokama and A. Banner, University of Hawaii, and Dr. S. Swerdloff, Marine Affairs Coordinator's Office, State of Hawaii, to discuss proposed funding for ciguatera research to be conducted on fishes collected by the Hawaii Division of Fish and Game and the Honolulu Laboratory.

- March 9 - H. Yoshida attended a meeting called by Mr. Doyle Gates, Director, Western Pacific Program Office, South-west Region, to discuss surveillance of the U.S. fishery conservation zone in the western Pacific with local Coast Guard representatives.
- 9-19 - Barrett traveled to Noumea, New Caledonia to participate in the South Pacific Commission (SPC) meeting of the Expert Committee on Tropical Skipjack and the 10th session of the SPC Technical meeting on fisheries.
- 12-14 - Lt. T. Jackson and C. Oliver, La Jolla Laboratory, in Port Orchard, Washington to inspect a plane as a possible vehicle for the planned aerial survey of porpoise populations.
- 12-15 - Dr. E. Hobson, Tiburon Laboratory, traveled to Seattle where he participated as a member of the NOAA Diving Safety Board at their annual meeting.
- Dr. R. Lasker traveled to Mazatlan, Mexico to attend a CalCOFI/Instituto Nacional de Pesca meeting.
- 13-14 - Richard Parrish, PEG, traveled to Sacramento to the California State Department of Fish and Game Office.
- 13-15 - Dr. Lenarz, Tiburon Laboratory, attended a meeting of the Groundfish Management Plan Development Team in Seattle.
- 13-19 - Fishery Biologists J. Jennings and W. Stuntz in Honolulu to conduct freeze branding and tagging tests on Hawaiian spinner dolphins as preliminary studies to large scale tagging.
- 15 - Ed Ueber, Tiburon Laboratory, traveled to Portland to award a contract to Earl Combs and Associates to do an inventory of socio-economic data related to fisheries on the coast for the Pacific Fishery Management Council.
- 15-16 Drs. Adams and Mendelssohn and Mr. Yoshida traveled to Kauai to attend the 10th meeting of the Western Pacific Regional Fishery Management Council at the Kauai Surf Hotel at Nawiliwili.
- 15-17 - Andrew Bakun, Richard Parrish and Donna Mallicoate, PEG, traveled to La Jolla to attend the Climate Fishery meeting.
- 18 - Dr. Jerry Wetherall returned to Honolulu after attending meetings in Manila and New Caledonia.

- March 21 - Fishery Biologist J. Squire, La Jolla Laboratory traveled to Westminster, California to meet with Peter Goadby, noted marine game fisherman and author from Sidney, Australia to discuss the cooperative tagging and billfish angler survey programs.
- 21-23 - Lasker traveled to Washington, D.C. to attend a meeting of the National Science Foundation Advisory Committee.
- 21-26 - Kathy Setbacken, PEG, traveled to Marion, Massachusetts to attend a workshop held by Sippican Corporation.
- 24-25 - Hazel Nishimura, Librarian, attended the annual Spring Conference of the Hawaii Library Association at the Princess Kaiulani Hotel.
- 27-28 - Mrs. Nishimura attended the Hawaii Copyright Institute sponsored by the University of Hawaii Graduate School of Library Studies at the University of Hawaii campus.
- Dr. W. Perrin in Santa Cruz, California to attend an organizational meeting of a marine mammal society that will sponsor the biannual marine mammal conference and possible launch a journal.
- Dr. J. Hunter of the La Jolla Laboratory and Mickey Eldridge of the Tiburon Laboratory attended a Title XII Aquaculture and Fisheries Development meeting at the University of California, Davis.
- 27-30 - Ben Remington, Executive Officer, in Los Angeles to attend a Performance Development Workshop.
- Dr. D. King traveled to Washington, D.C. to attend a planning session for study of tuna vessel flag transfers.
- 28 - Director Barrett and Dr. Fox were invited guests at the dedication ceremony for the Fishermen's Pier which is the newest facility in San Diego Bay for the commercial fisherman. The pier has been under construction since May 1977 and provides berthing space for four tuna seiners on the outer side of the pier and one tunaboat on the inner side. The floating dock system inside the pier will accommodate 32 smaller fishing vessels.
- 28-31 - Dr. R. Lasker, La Jolla Laboratory and A. Bakun and R. Parrish, PEG, attended the Climate and Fisheries Workshop sponsored by the University of Rhode Island Center for Ocean Management Studies.

- March 29 - Dr. Fox met with Mexican scientists at the La Jolla Laboratory on future of possible coordinated marine mammal research in the Pacific.
- 31 - Dr. G. Sakagawa and J. Squire were in Long Beach, California at the California Department of Fish and Game headquarters in Long Beach. With B. Bell of the CF&G they will prepare the eastern Pacific portion of the management plan for billfishes and sharks in coordination with representatives of the Central Pacific Management Council.
- Dr. Fox and Center Director Barrett traveled to Terminal Island to participate in a planning meeting on the U.S. position for renegotiating the Inter-American Tropical Tuna Commission.

VISITORS

Honolulu Laboratory

- March 6 - Tamio Otsu was visited by Witold Klawe, IATTC, who was en route to American Samoa, New Caledonia, Taiwan, Japan, and Korea on a data-collecting mission for the South Pacific Commission.
- 7 - Carrie Kuwada, a student at St. Andrews Priory High School visited the Laboratory in connection with her school's career day activities. Ray Sumida guided her around the Laboratory.
- 28 - Dr. Izumi Nakamura, Kyoto University, and Mrs. Nakamura.

La Jolla Laboratory

- March 8 - Irving Warren and Peter Jackson, Alaska Department of Fish and Game, Kodiak, Alaska here to discuss the application of aerial photography and low light level television to stock estimation of herring and capelin in the Bering Sea.
- 13 - Dr. Doug Lipka, NMFS, Washington, D.C.
- Mel Odemar, CF&G, Sacramento
- 13-14 - Arnett Taylor, Northeast Region, to discuss tagging of giant bluefin tuna.
- 22 - Dr. Al Erickson, University of Washington, with several of his students.

- March 21 - Lisa A. Rossbacher, Princeton University, Princeton, New Jersey.
- 28 - T. J. McIntyre, NMFS, Washington, D.C.
- 29 - Tasuhiko Shimazu, University of Washington, Seattle.

Pacific Environmental Group

- March 6-9 - Iz Barrett, R.M. Laurs, SWFC; Lamarr Trott, Robert Pedrick, Elizabeth Haynes, Julian Goulet, NMFS, Washington, D.C.; Mert Ingham, W. Chamberlin, Atlantic Environmental Group, R.I.; Felix Favorite, NWAFC, Seattle, Washington; John Brucks, NMFS, Bay St. Louis, MS; and R. Straty, Auke Bay Lab., Alaska.
- 10 - Marian Yong, Honolulu Lab., HI.
- 20 - Henry Mellow and Kevin Ia Graff, State Assembly.

Tiburon Laboratory

- March 14 - Dr. Douglas Lipka, NMFS, Washington, D.C.
- 21 - Joe and Robin Valencic, Saddleback College, Dana Pt., California.
- 24 - Jeff Young, Humboldt State University, Arcata, California.
- Izumi Nakamura and Reiko Nakamura, Kyoto University, Kyoto, Japan.
- 27 - Dean Farrell, Miami, Florida.
- Bob Hoffman, NMFS, Terminal Island.
- 30 - Howard Smalheiser, College of Marin, Kentfield.
- Jean Jacobs, California Academy of Sciences, San Francisco.
- 31 - Akeo Yoshikawa, Taito Seiko, Ltd., Tokyo, Japan.

PERSONNEL

- March 6 - Kathleen Dorsey, Biological Technician, Temporary Appointment - La Jolla Laboratory.
- 8 - Richard W. Kisthard, Economist, Temporary, Part-Time Appointment - Honolulu Laboratory.

- March 12 - Virginia L. Ishida, Clerk-Typist, Promotion - Honolulu Laboratory.
- Edward Ueber, Industrial Economist, Promotion - Tiburon Laboratory.
- Richard Charter, Biological Technician, Promotion - La Jolla Laboratory.
- Merle Marrow, Maintencenceman, Promotion - La Jolla Laboratory.
- 13 - Rennie Holt, Operations Research Analyst, EOD, La Jolla Laboratory.
- 20 - Joan Woodward, Clerk-Steno, Appointment - Tiburon Laboratory.
- 25 - Chet Chaffee, Biological Aid, Termination, Tiburon Laboratory.
- Kathleen Fouree, Biological Aid, Termination - Tiburon Laboratory.
- 26 - Elaine Sandknop, Biological Laboratory Technician, Promotion - La Jolla Laboratory.
- Elizabeth Stevens, Biological Laboratory Technician, Promotion - La Jolla Laboratory.
- Eugene Holzapfel, Biological Technician, Promotion, La Jolla Laboratory.
- William Perrin, Fishery Biologist, Promotion - La Jolla Laboratory.
- Joseph Powers, Wildlife Biologist, Promotion - La Jolla Promotion.

TRAINING

Mary Lynne Godfrey, Administrative Officer, and Richard Uchida, Fishery Biologist at the Honolulu Laboratory, attended the Performance Evaluation and Career Counseling Workshop conducted by Judith B. Tenney, Chief, Career Development Branch, NOAA, at the Prince Kuhio Federal Building. The 3-day workshop emphasized effective methods and techniques in handling supervisory responsibilities.

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